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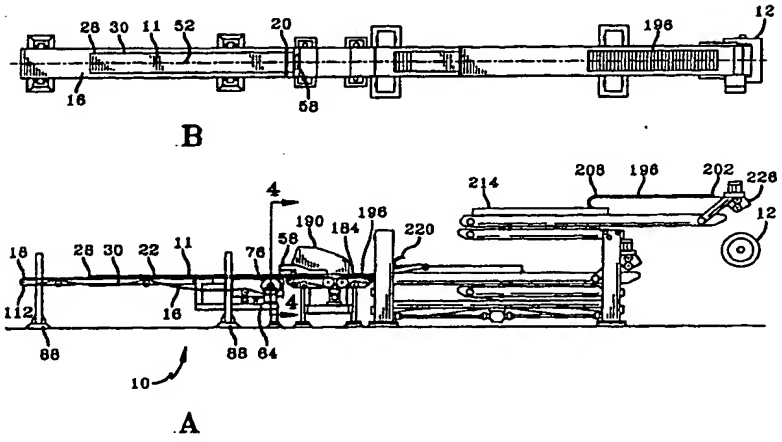

(57) Abstract

A method and apparatus for conveying and applying a strip component (11) such as a tire tread is disclosed. The method includes the steps of placing the strip component on a belt conveyor (16), determining a guideline (52) of the strip component (11) at an exit end (20) of the belt conveyor (16), and laterally adjusting the exit end (20) of the belt conveyor (16) to align the guideline (52) of the strip component (11) with a predetermined guideline such as the guideline of a tire building drum (12). The apparatus includes a belt support transverse housing (76) which is laterally moveable by a motion controller (64) in response to a sensor (58) which detects the guideline (52) of the strip component (11). Guides on the transverse housing (76) move the belts of the conveyor (16) on slider plates without physically touching the conveyed strip component (11), thereby preventing damage to the component material. The invention described above may be utilized in a single conveyor, or in multiple conveyor apparatus where the conveyors may be keyed together for synchronized transmission of the components.

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GUIDE CONVEYOR HAVING A LATERALLY ADJUSTABLE DEFLECTOR ROLLER AT THE END

Technical Field

This invention pertains to the art of methods and apparatuses for conveying materials, such as strip components on a belt conveyor, and more specifically to methods and apparatuses for conveying tire building components from a feeding extruder or other production location to a tire building drum on a belt conveyor which is capable of laterally adjusting the position of the components without using guides.

Background Art

In the past, guides on conveyor belts such as pivoting steering rollers required strip component wrap-around to create traction for centering the component product which was often detrimental to the component. Also, self-feeding of many components through any type of rollers was unreliable.

Other methods included shifting the entire conveyor laterally to center the product. However, this required more elaborate machinery and a large entry loop in the case of strip or web products. Large loops may cause product stretch and make self-feeding difficult.

Another guiding method utilized curved modular belt conveyors however, the curves were static and did not act as active guides. Further, the belting typically used was more than twice the pitch length of that utilized by the present invention. Long pitch lengths introduce excessive speed undulation to the product due to chordal action at the sprockets.

The present invention contemplates a new and improved flexible guide belt conveyor which is simple in design, effective in use, and overcomes the foregoing difficulties and others while providing better and more advantageous overall results.

Disclosure of Invention

In accordance with the present invention, a new and improved flexible guide belt conveyor is provided which allows for active guiding of a fragile strip component on a feeder conveyor without using guides in contact with the material of the strip component.

More particularly, in accordance with one aspect of this invention, there is provided a method of conveying a tread member to a tire building drum and aligning the tread member with a guideline of intervening conveyors and the drum including the steps of placing a tread member on a belt conveyor having an entrance end and an exit end, the method characterized by the steps of determining a location of the guideline of the tread member at the exit end of the belt conveyor using a sensor, transmitting the location of the guideline to a motion controller, and moving a

transverse housing located at the exit end laterally to adjust the exit end of the belt conveyor to align the tread member with the guideline of a tire building drum.

According to another aspect of the invention, there is provided a method of applying tire components to a tire building drum including the step of transferring the tire components on at least one belt conveyor having an entrance end and an exit end, the method characterized by the steps of determining a location of the guideline of the tread member at the exit end of the at least one belt conveyor by means of a sensor, activating a linear actuator to laterally move the transverse housing located at the exit end to adjust the exit end of at least one belt conveyor to align the tread member with a guideline of a tire building drum.

In accordance with another aspect of the invention, there is provided an apparatus for adjusting an exit end of a belt conveyor having a belt including modules joined by hinge pins with spaces between the modules thereby providing lateral flexibility of the belt characterized by the belt conveyor having a fixed frame at an entrance end and a laterally moveable transverse housing at the exit end, the transverse housing having a slide member to support and permit lateral adjustment of the belt conveyor.

In accordance with a further aspect of the invention, there is provided an apparatus for adjusting exit ends of a plurality of belt conveyors, each of the belt conveyors comprising a plurality of spaced apart modules supported by hinge pins thereby providing lateral flexibility characterized by each of the belt conveyors having a fixed frame at an entry end and a laterally moveable transverse housing at one of the exit ends, and the fixed frame and the transverse housing having slide plates to support and permit lateral adjustment of the belt conveyors.

In accordance with a still further aspect of the invention, there is provided a method of adjusting an exit end of a belt conveyor conveying a strip component characterized by the steps of sensing a position of a guideline of the strip component with sensing means, and activating a linear actuator to move a transverse housing of the conveyor, thereby moving a belt on the conveyor and the strip component until the guideline of the strip component is centered with respect to a predetermined position.

One advantage of the present invention is its ability to laterally adjust the position of a component transported on a conveyor belt without contacting the edges of the component.

Another advantage of the present invention is its ability to synchronize the movement of strip components on at least two conveyor belts.

Another advantage of the present invention is its ability to adjust the positions of the

guidelines of multiple components on multiple conveyor belts.

Still other benefits and advantages of the invention will become apparent to those skilled in the art to which it pertains upon a reading and understanding of the following detailed specification.

Brief Description of Drawings

The invention may take physical form in certain parts and arrangement of parts, a preferred embodiment of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part hereof and wherein:

Figure 1A is a schematic side elevation of a single belt conveyor assembly embodying the invention;

Figure 1B is a schematic plan view of the belt conveyor shown in Figure 1;

Figure 2 is a enlarged fragmentary plan view of a laterally flexible conveyor belt adapted for use in the embodiment of Figures 1A and 1B;

Figure 3 is an enlarged cross section of a tire tread of Figures 1A and 1B showing the raised guideline rib;

Figure 4 is a detailed cross sectional view of the exit end of the belt conveyor assembly according to the present invention taken along the line 4-4 of Figure 1A with parts being broken away;

Figure 5 is a view like Figure 4 showing a two conveyor assembly;

Figure 6 is a sectional view through the traversing section taken along line 6-6 of Figure 4; and,

Figure 7 is a schematic plan view of the two conveyor system shown in Figures 5 and 6.

Detailed Description of the Invention (optional)

Referring now to the drawings wherein the showings are for purposes of illustrating a preferred embodiment of the invention only and not for purposes of limiting the same, Figure 1A shows a side elevation of a conveyor assembly 10 for conveying strip materials such as a tire tread 11 to a tire building drum 12. The conveyor assembly 10 preferably includes at least one feed belt conveyor 16 having an entrance end 18 and an exit end 20 that is capable of carrying the tire tread 11. The feed belt conveyor 16 preferably utilizes a laterally flexible conveyor belt having linked modules 34 with links 36 joined by hinge pins 40, as shown in Figure 2. There is preferably a small amount of clearance between the links 36 of the modules 34, thereby permitting limited

lateral shifting and flexibility of the conveyor belt 28. While the conveyor belt 28 described above is the preferred embodiment, any other type of conveyor belt 28 with lateral flexibility may be utilized with the present invention.

With continuing reference to Figures 1A and 1B, the continuous tire tread 11 is conveyed by the feed conveyor 16 from a feeding position 30 to the exit end 20 and preferably has a guideline rib 52, as shown in Figure 3. The guideline rib 52 as shown in Figure 3 is along the centerline of tire tread 11. However, the guideline rib 52 may also be off center. The guideline rib 52 may be detected by a die-line sensor 58. The sensor 58 determines the relative location of the guideline rib 52 of the tire tread 11 and provides an analog signal that is transmitted to a motion controller assembly 64. The motion controller assembly 64 uses the analog signal for negative feedback to a position loop that controls the lateral location of the exit end 20 of the feed belt conveyor 16. Guiding occurs as a result of the feed belt conveyor 16 moving laterally in the direction of travel of the tire tread 11 in response to the negative feedback from the sensor 58. In the preferred embodiment, the sensor 58 consists of a retro-reflective infrared scanner and a DOS based PC-compatible computer and monitor.

The motion controller 64 moves the exit end 20 of the feed belt conveyor 16 laterally at 90° to the direction of the feed conveyor 16. The exit end 20 of the feed belt conveyor 16 includes a lateral adjustable transverse housing 76. The entrance end 18 of the feed conveyor 16 is preferably fixed, and is supported by a fixed frame 88.

The transverse housing 76, as viewed in Figure 6, preferably has a slider plate 94 to support the conveyor belt 28. As shown in Figure 4, guides 100, which may be made of plastic or any other suitable material, are preferably provided to ensure that the conveyor belt 28 is not skewed as it enters and leaves sprockets 106. Belt idler sprockets 112, and shafting (not shown) are mounted at the entrance end 18 of the feed conveyor 16, as shown in Figure 1A.

With continuing reference to Figure 4, the transverse housing 76 which encloses the belt drive sprockets 106 and bearings 118 that support most of the weight of the transverse housing is carried on a hollow shaft 124. The remaining weight of the transverse housing 76 is carried by a ball bushing 130 on a shaft 132 mounted on the frame 88, as shown in Figure 6.

Two ball spline nuts 136, 142 mounted on a drive shaft 144 are retained inside the hollow shaft 124 of the transverse housing 76. One ball spline nut 136 is keyed on its outside diameter 148 to the inside diameter 154 of the hollow shaft 124 for torque transmission. The drive shaft 144 which is supported by pillow blocks 160 and 162, is coupled to a servo motor drive 166.

Lateral transverse movement of the hollow shaft 124 and transverse housing 76 is provided preferably by a dedicated DC motor-powered linear actuator 172 connected to the housing by arm 174 when activated and controlled by the motion controller 64.

This assembly at the exit end 20 provides low friction lateral motion of the transverse housing 76. At the beginning of a strip component run, the transverse housing 76 is automatically positioned in its center position by the motion controller 64 of the linear actuator 172. The strip material 22 is placed on the feed conveyor 16 at a location on the conveyor belt 28 which is not critical. The strip material 22 is easily self fed through the guide section. The position of the strip material 22 exiting the feed belt conveyor 16 is monitored by the sensor 58. If an off center position of the strip material 22 is detected, the motion controller 64 moves the transverse housing 76 laterally by activating the linear actuator 172. The plastic guides 100 which are fixed to the transverse housing 76 force the belt 28 to move with the transverse housing 76. The radially extending part of the guides 100 act as fulcrums when the belt 20 shifts sideways. The inherent lateral flexibility of the conveyor belt 28 permits this movement while the slider plate 94 supports the belt as described above. The strip material 22 is accordingly presented to downstream equipment on center and in line with the guideline of the conveyor assembly 10.

Heretofore, the present invention has been described with regards to a single belt feed conveyor 16. However, the invention may also be utilized for two or more belt feed conveyors 16′,16″, as shown in Figure 5. Figures 6 and 7 show additional views of the two conveyor assembly as shown in Figure 5. In the case of two belt feed conveyors 16′,16″, the hollow shafts 124′,124″ are preferably keyed to the drive shaft 144 and coupled together. This allows for the two transverse housings 76′,76″ to be driven by a single motor. Slider plates 94′, 95″ not shown are similar to slider plate 94 shown in Figure 6 and support the laterally adjustable conveyor belts 28′, 28″.

The multiple transverse housings 76′,76″ arrangement provides continued low friction independent lateral movement of the transverse housings as well as synchronized line speed of the conveyor belts 28′,28″. If non-synchronized speeds of conveyor belts 28′,28″ are desired, the splined hollow shafts 124′,124″ may be uncoupled and driven by separate drives.

Referring to Figure 1A, after the strip material 22 such as tire tread 11 is conveyed by the feed conveyor 16 and is centered by the transverse housing 76, the tread 11 may be applied directly to a tire drum 12. In the preferred embodiment, as shown in Figures 1A and 2B, the tread 11 is centered by the transverse housing 76 and transferred to a cut conveyor 184 where it

is cut by a cut conveyor knife 190. After being cut by the knife 190, the tread 196 has a leading end 202 and a tail end 208. The tread 196 which is still in the centered position is then transferred onto a tread applier 214 and conveyed to the tire building drum 12 where it is applied in the centered position to the drum.

The method described above is typically used when the strip material 22 is a tread 11 and consists of tread material. The tread 11 shown and described in the preferred embodiment of Figures 1A and 1B, only requires the single feed conveyor 16 as described above.

The preferred embodiments have been described, hereinabove. It will be apparent to those skilled in the art that the above apparatus and methods may incorporate changes and modifications without departing from the general scope of this invention. It is intended to include all such modifications and alterations in so far as they come within the scope of the appended claims or the equivalents thereof.

Having thus described the invention, it is now claimed:

CLAIMS

1. A method of conveying a tread member with a guideline to a tire building drum with a guideline and aligning said tread member with said tire building drum comprising the steps of placing said tread member on a belt conveyor having an entrance end and an exit end, said method characterized by the steps of:

(a) determining a location of a guideline of said tread member at said exit end of said belt conveyor by means of a sensor;

(b) laterally adjusting said exit end of said belt conveyor to align said guideline of said tread member with said guideline of said tire building drum in response to the determination of the location of said guideline of said tread member at said exit end.

2. The method of claim 1 wherein a cut conveyor having a guideline in alignment with said guideline of said tire building drum is positioned between said belt conveyor and said tire building drum, the method further characterized by the steps of:

(a) transferring said tread member to said cut conveyor; and,

(b) cutting said tread member to produce a tread member having a leading end and a tail end.

3. The method of claim 2 wherein a tread applier having a guideline in alignment with said guideline of said tire building drum is positioned between said cut conveyor and said tire building drum, the method further characterized by the steps of:

(a) feeding said tread member onto said applier;

(b) moving said applier toward said tire building drum;

(c) advancing said tread member; and,

(d) applying said tread member to said tire building drum.

4. Apparatus for conveying a tread member having a guideline to a tire building drum having a guideline comprising a belt conveyor having an entry and an exit end characterized by:

(a) said belt conveyor having a fixed support at said entry end and a laterally movable belt supporting transverse housing at said exit end, a laterally adjustable belt extending from said entry end to said exit end and over said transverse housing;

(b) sensor means for determining the guideline of said tread member at said exit end; and,

(c) means for adjusting said transverse housing so that said guideline of said tread member at said exit end will be aligned with said guideline of said tire building drum.

5. The apparatus of claim 4 further characterized by:

(a) a cut conveyor and a tread member applier providing intervening conveyors interposed between said belt conveyor and said tire building drum, said intervening conveyors each having a guideline the same as said guideline of said tire building drum.

6. A method of conveying an elongated strip component and centering said strip component comprising the step of conveying said component on a first belt conveyor having an entrance end and an exit end, said method being characterized by the steps of:

(a) determining a location of a guideline of said elongated strip member at said exit end of said at first belt conveyor using a sensor;

(b) transmitting said location of said guideline to a motion controller; and,

(c) activating a linear actuator to laterally move a belt supporting transverse housing located at said exit end to adjust said exit end of said first belt conveyor to align said elongated strip member with a predetermined guideline at said exit end.

7. The method of claim 6 further comprising a second belt conveyor for conveying a second elongated strip component and centering said second strip component about a second guideline further characterized by driving said first belt conveyor and said second belt conveyor at the same speed with a single drive means.

8. A belt conveyor having an entry end and an exit end, apparatus for adjusting said exit end of a belt conveyor including a laterally adjustable belt characterized by:

(a) said belt conveyor having a fixed support at an entry end, a laterally movable belt supporting transverse housing at said exit end, and slide plates to support and permit lateral movement of said belt at said exit end.

9. The apparatus of claim 8 further characterized by:

(a) said transverse housing enclosing a belt drive sprocket, bearings, and a drive shaft assembly, said belt drive sprocket and said bearing being carried on a hollow shaft, said hollow shaft retaining a first ball spline nut and a second ball spline nut slidably mounted on said grooved drive shaft, said first ball spline nut having an outer diameter keyed to an inner diameter of said hollow shaft for torque transmission.

10. The apparatus of claim 9 further characterized by:

(a) means for laterally moving said belt supporting transverse housing along said hollow shaft, said means for laterally moving said transverse housing

comprising a linear actuator and at least two edge guides for moving said belt transversely at said exit end; and,

(b) said belt drive sprocket of said transverse housing being rotated by rotation of said drive shaft assembly.

11. An apparatus for adjusting an exit end of a belt conveyor, said belt conveyor having a belt comprising modules joined by hinge pins thereby providing lateral flexibility, said apparatus characterized by:

(a) said belt conveyor having a fixed frame at an entry end and a laterally movable transverse housing at said exit end, said fixed frame and said transverse housing having slide plates to support said belt conveyor.

12. The apparatus of claim 11 further characterized by:

(a) said transverse housing enclosing a belt drive sprocket, bearings, and a drive shaft assembly connected to said housing for rotating said housing and said belt drive sprocket and said bearing being carried on a hollow shaft, said hollow shaft retaining a first ball spline nut and a second ball spline nut carried on a drive shaft, said first ball spline nut having an outer diameter keyed to an inner diameter of said hollow shaft for torque transmission from said drive shaft.

13. The apparatus of claim 12 further characterized by:

(a) means for laterally moving said transverse housing, comprising a linear actuator and at least two guides mounted on said housing for transverse movement of said belt conveyor; and,

(b) said transverse housing being rotatable by rotation of said drive shaft.

14. A method of adjusting an exit end of a belt conveyor conveying a strip component to a predetermined position, said method characterized by the steps of:

(a) sensing a position of said strip component at said exit end; and,

(b) activating a linear actuator to move a transverse belt carrying housing at said exit end of said conveyor to move said belt and said strip component until said predetermined position of said strip component is reached.

AMENDED CLAIMS

[received by the International Bureau on 21 September 1998 (21.09.98);
Original claims 4,8 to 14 amended; remaining claims unchanged
(3 pages)]

1. A method of conveying a tread member with a guideline to a tire building drum with a guideline and aligning said tread member with said tire building drum comprising the steps of placing said tread member on a belt conveyor having an entrance end and an exit end, said method characterized by the steps of:

(a) determining a location of a guideline of said tread member at said exit end of said belt conveyor by means of a sensor;

(b) laterally adjusting said exit end of said belt conveyor to align said guideline of said tread member with said guideline of said tire building drum in response to the determination of the location of said guideline of said tread member at said exit end.

2. The method of claim 1 wherein a cut conveyor having a guideline in alignment with said guideline of said tire building drum is positioned between said belt conveyor and said tire building drum, the method further characterized by the steps of:

(a) transferring said tread member to said cut conveyor; and,

(b) cutting said tread member to produce a tread member having a leading end and a tail end.

3. The method of claim 2 wherein a tread applier having a guideline in alignment with said guideline of said tire building drum is positioned between said cut conveyor and said tire building drum, the method further characterized by the steps of:

(a) feeding said tread member onto said applier;

(b) moving said applier toward said tire building drum;

(c) advancing said tread member; and,

(d) applying said tread member to said tire building drum.

4. Apparatus for conveying a tread member having a guideline to a tire building drum having a guideline comprising a belt conveyor having an entrance end and an exit end characterized by:

(a) said belt conveyor having a fixed support at said entrance end and a laterally movable belt supporting transverse housing at said exit end, a laterally adjustable belt extending from said entrance end to said exit end and over said transverse housing;

(b) sensor means for determining the guideline of said tread member at said exit end; and,

(c) means for adjusting said transverse housing so that said guideline of said tread member at said exit end will be aligned with said guideline of said tire building drum.

5. The apparatus of claim 4 further characterized by:

(a) a cut conveyor and a tread member applier providing intervening conveyors interposed between said belt conveyor and said tire building drum, said intervening conveyors each having a guideline the same as said guideline of said tire building drum.

6. A method of conveying an elongated strip component and centering said strip component comprising the step of conveying said component on a first belt conveyor having an entrance end and an exit end, said method being characterized by the steps of:

(a) determining a location of a guideline of said elongated strip member at said exit end of said at first belt conveyor using a sensor;

(b) transmitting said location of said guideline to a motion controller; and,

(c) activating a linear actuator to laterally move a belt supporting transverse housing located at said exit end to adjust said exit end of said first belt conveyor to align said elongated strip member with a predetermined guideline at said exit end.

7. The method of claim 6 further comprising a second belt conveyor for conveying a second elongated strip component and centering said second strip component about a second guideline further characterized by driving said first belt conveyor and said second belt conveyor at the same speed with a single drive means.

8. A belt conveyor having an entrance end and an exit end, apparatus for adjusting said exit end of a belt conveyor including a laterally adjustable belt characterized by:

(a) said belt conveyor having a fixed support at said entrance end, a laterally movable belt supporting transverse housing at said exit end, drive means mounted on said transverse housing, at least two edge guides mounted on transverse said housing for guiding said belt transversely at said entrance end,, and slide plates mounted on said housing to support and permit lateral movement of said belt at said exit end.

9. The apparatus of claim 8 further characterized by:

(a) said transverse housing including a belt drive sprocket, bearings, and a grooved drive shaft, said belt drive sprocket and said bearings being carried on a hollow shaft, said hollow shaft retaining a first ball spline nut and a second ball spline nut slidably mounted on said grooved drive shaft, said first ball spline nut having an outer diameter keyed to an inner diameter of said hollow shaft for torque transmission.

10. The apparatus of claim 9 further characterized by:

(a) means for laterally moving said belt supporting transverse housing along said hollow shaft, said means for laterally moving said transverse housing comprising a linear actuator and,

(b) said belt drive sprocket of said transverse housing being rotated by rotation of said drive shaft.

11. An apparatus for adjusting an exit end of a belt conveyor, said belt conveyor having a belt comprising modules joined by hinge pins thereby providing lateral flexibility, said apparatus characterized by:

(a) said belt conveyor having a fixed frame at an entrance end and a laterally movable transverse housing at said exit end, said fixed frame and said transverse housing having slide plates to support said belt conveyor.

12. The apparatus of claim 11 further characterized by:

(a) said transverse housing including a belt drive sprocket, bearings, and a drive shaft connected to said housing for rotating in said housing and said belt drive sprocket and said bearing being carried on a hollow shaft, said hollow shaft retaining a first ball spline nut and a second ball spline nut carried on said drive shaft, said first ball spline nut having an outer diameter keyed to an inner diameter of said hollow shaft for torque transmission from said drive shaft.

13. The apparatus of claim 12 further characterized by:

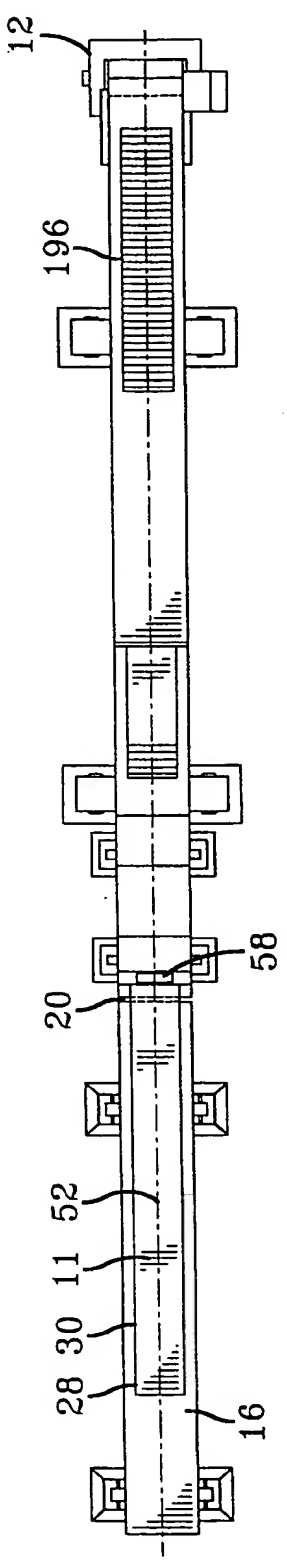
(a) means for laterally moving said transverse housing, comprising a linear actuator and at least two guides mounted on said housing for transverse movement of said belt conveyor; and,

(b) said hollow shaft being rotatable by rotation of said drive shaft.

14. A method of adjusting an exit end of a belt conveyor conveying a strip component to a predetermined position, said method characterized by the steps of:

(a) sensing a position of said strip component at said exit end; and,

(b) activating a linear actuator to move a transverse belt carrying housing at said exit end of said conveyor to move said belt and said strip component until said predetermined position of said strip component is reached.


12
196
58
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52
11
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16

FIG-1B

226
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202
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208
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220
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184
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58
4
4
76
64
88
11
16
22
30
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112

FIG-1A

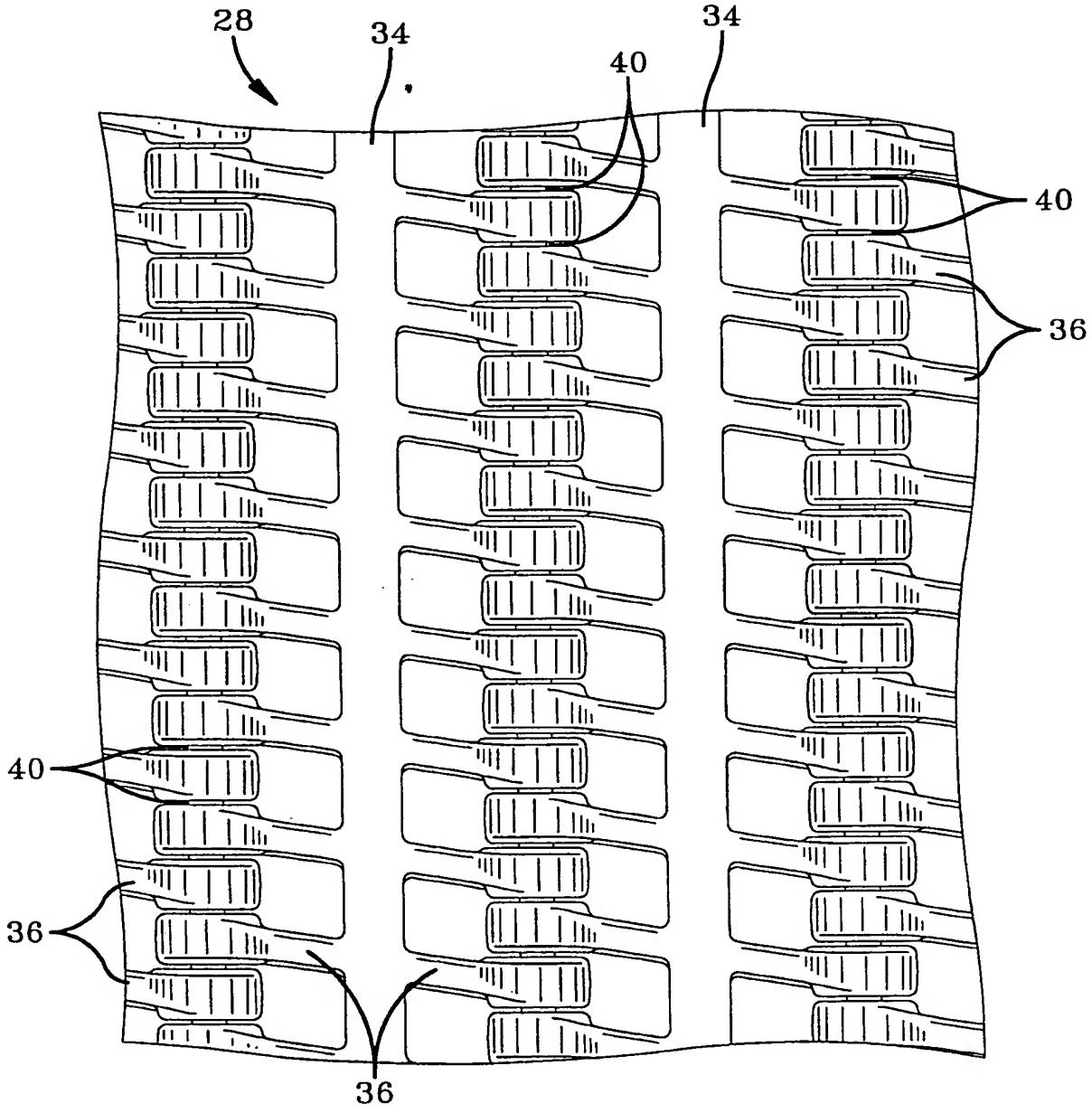


FIG-2

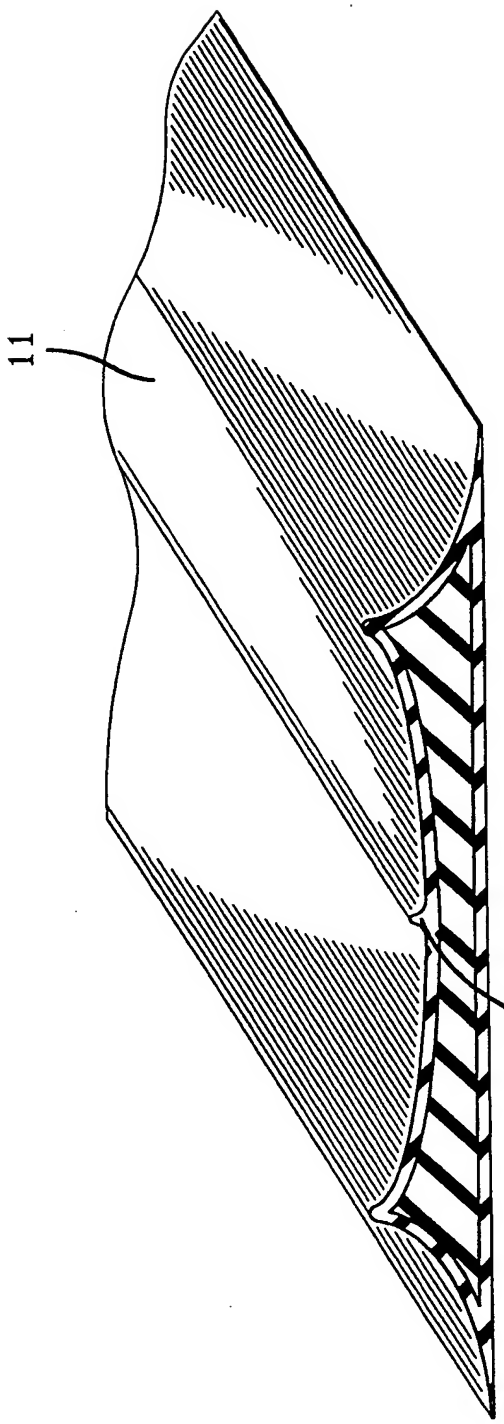
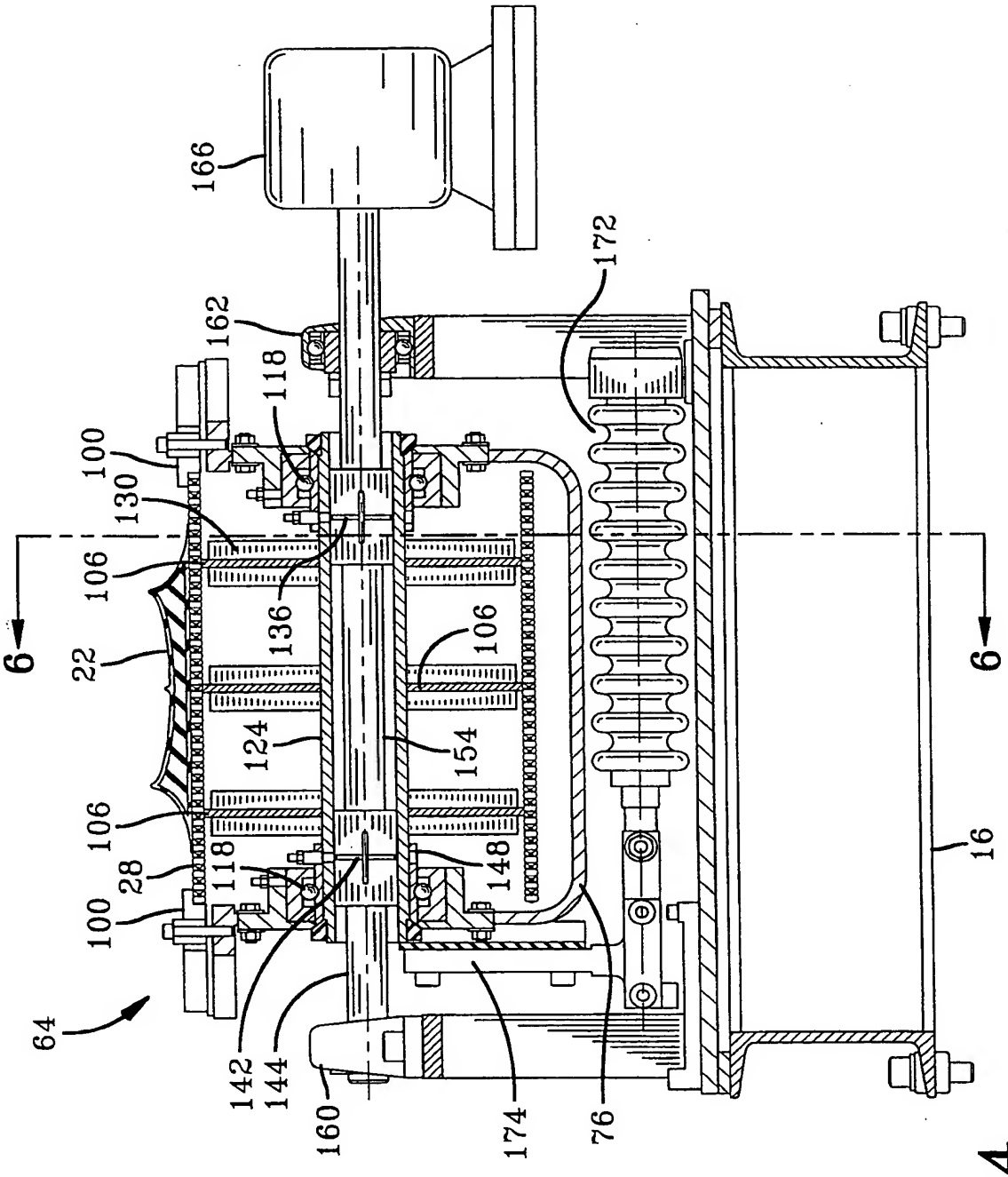


FIG-3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172
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130
106
136
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28
100
64
142
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174
76
16
6
6

FIG-4

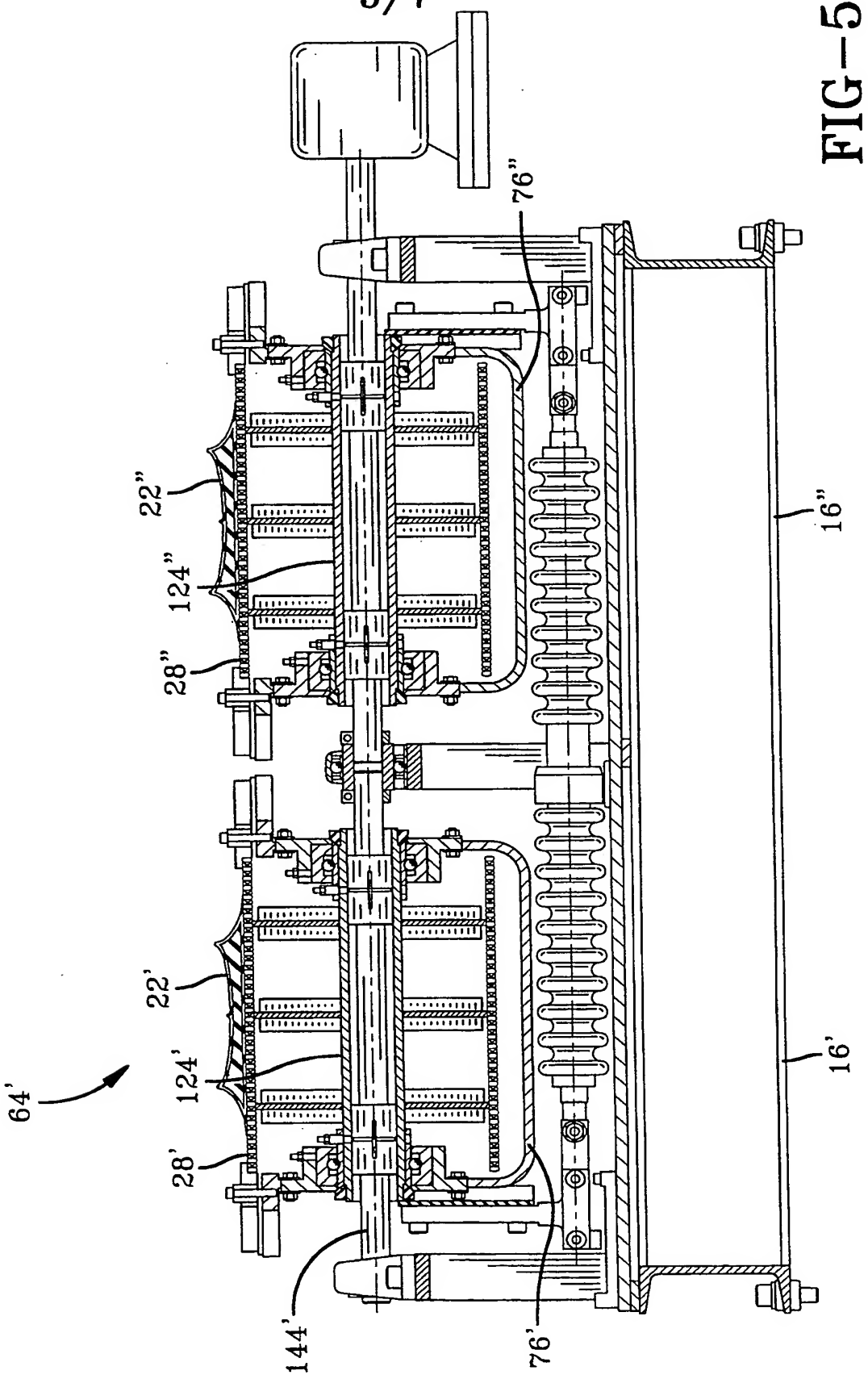

FIG-5

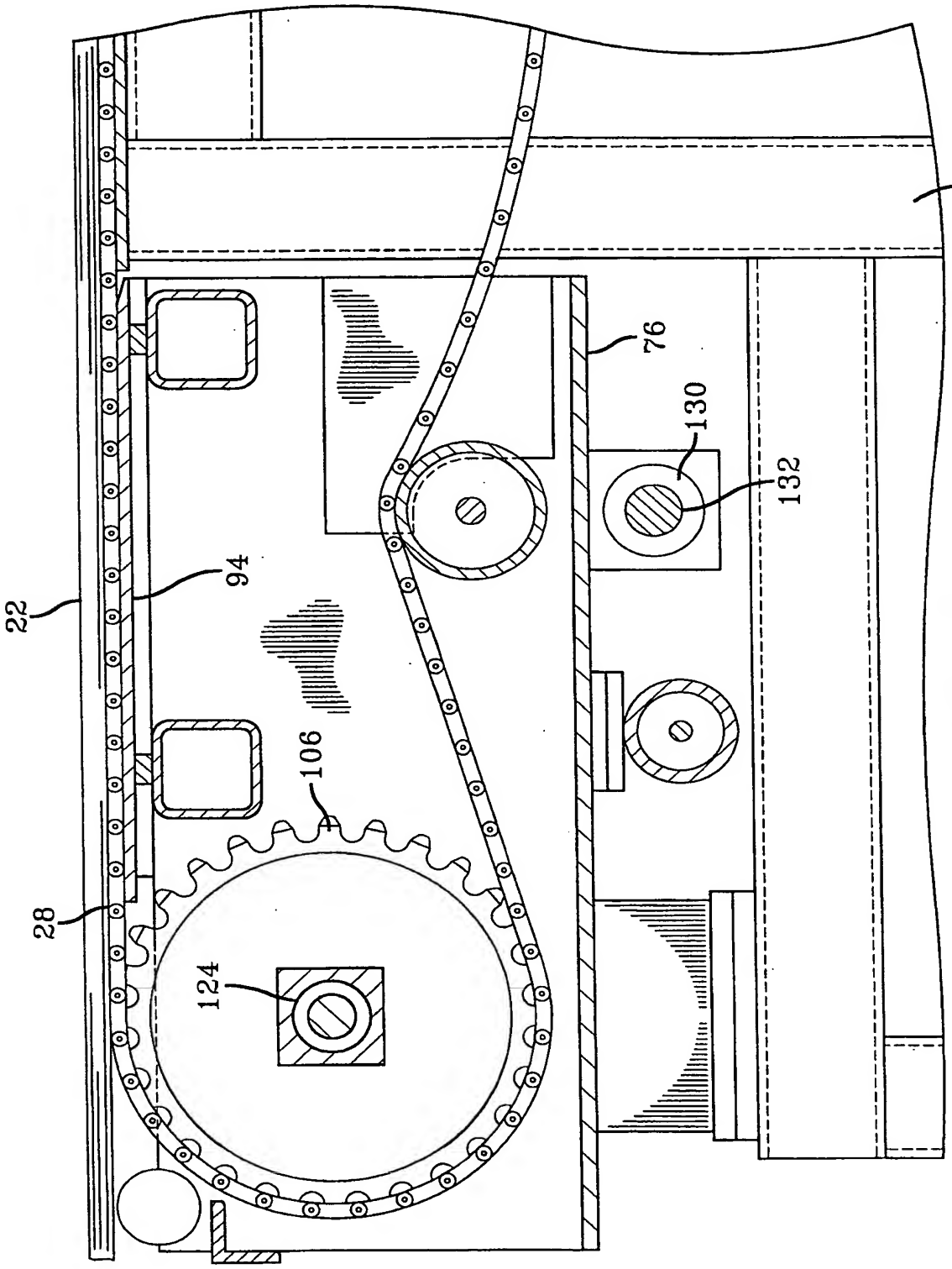

FIG-6

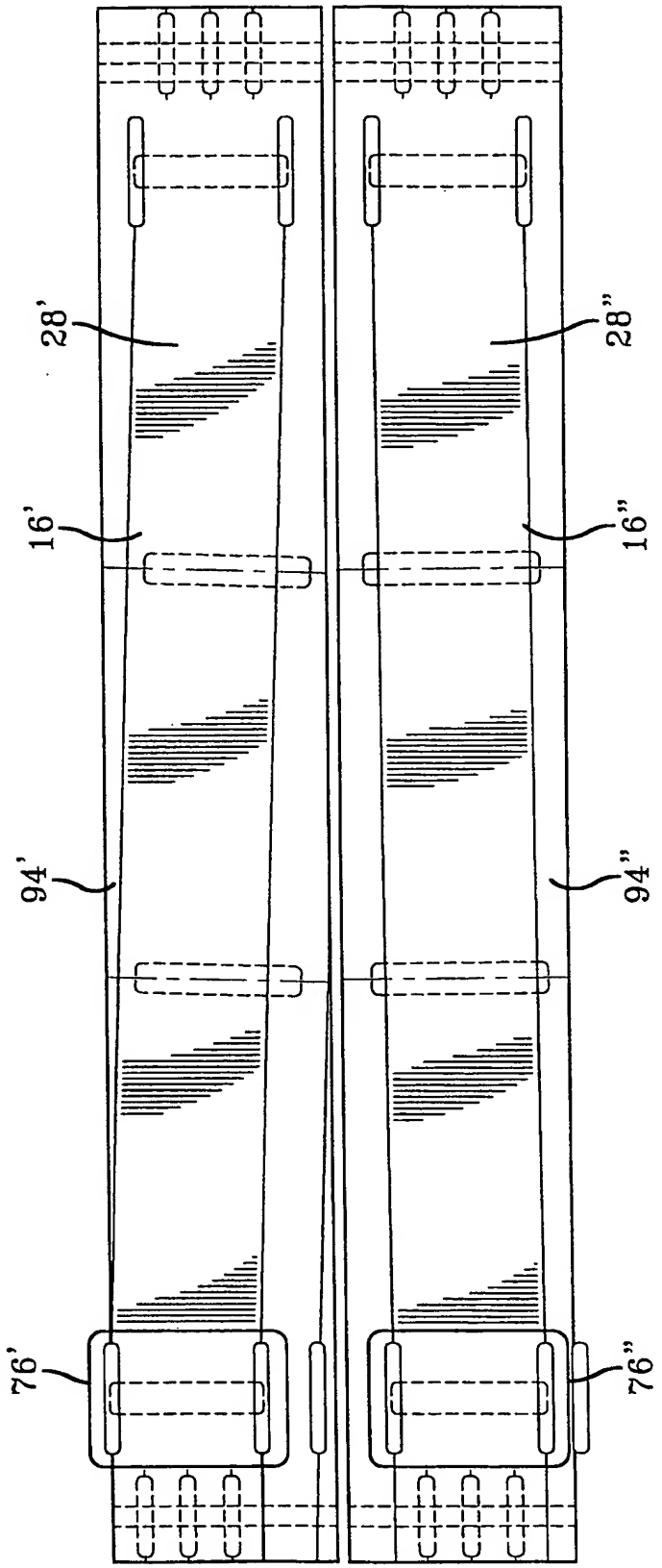

FIG-7

INTERNATIONAL SEARCH REPORT

Int. ational Application No
PCT/US 98/03324

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65G39/16 B29D30/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65G B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	WO 98 04488 A (GOODYEAR TIRE & RUBBER ;MURRAY THOMAS ALAN (US); RING RALPH DAMON) 5 February 1998 see abstract; figure 1	1 4,8,11, 14
Y	EP 0 508 304 A (DIXIE UNION VERPACKUNGEN GMBH) 14 October 1992 see column 4, line 36 - column 5, line 13; figures 1,2	4,8,11, 14

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 August 1998	20/08/1998

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Hillebrand, A

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Int. Ional Application No
PCT/US 98/03324

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9804488 A	05-02-1998	AU 6628296 A	20-02-1998
EP 0508304 A	14-10-1992	DE 4111837 A	15-10-1992